PATENT SPECIFICATION 1,001,629

DRAWINGS ATTACHED.

Inventor:—DONALD LIONEL HORE.

1,001,629

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COMPLETE SPECIFICATION.

Improvements in or relating to Actuating Mechanisms, More Particularly for Fluid Flow Control Valves.

We, ROTORK ENGINEERING COMPANY LIMITED, a British Company, of Brassmill Lane, Lower Weston, Bath, Somerset, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to actuating mechanisms, more particularly but not exclusively for the actuation of hand operated or power operated fluid flow control valves which require a rotary movement. The invention is particularly applicable for use with conventional valve actuators in which the valve member is normally actuated by the axial travel of the output spindle of the actuator in response to rotation of the driving nut of the actuator.

Such conventional valve actuators as described above operate satisfactorily with rising spindle valves and the present invention has for its main object the provision of an actuating mechanism whereby such conventional actuators can be used to operate valves having a rotary movement, such as plug valves or butterfly valves.

A further object of the invention is to provide an improved actuating mechanism which is particularly useful for the operation of valves or other mechanism having a rotary movement, but which is also applicable as a mechanism for converting a linear or reciprocating movement into a rotary movement.

In its broadest aspect the invention provides an actuating mechanism, more particularly for valves having a rotary movement, said mechanism comprising a fixed casing, an input member axially movable in said casing, a cross head or like member carried by said input member and constrained to follow a helical path when the input member is moved axially, said cross head extending through a rotatable casing in said fixed casing and being mounted therein for relative axial movement thereto whereby the helical movement of the cross head imparts a rotational movement to said rotatable casing.

In the preferred embodiment of the invention the cross head is provided with rollers or like members at its ends which engage helical grooves or slots in the side walls of the fixed casing. Furthermore the cross head is provided with rollers or like members intermediate its ends and which engage axial slots in the rotatable casing. The helical grooves or slots may be at a fixed angle or at a variable angle so as to provide a desired output characteristic for the mechanism. The rotatable casing is fixedly attached to an output member such as a shaft which extends from the fixed casing and is thereby rotatable in response to axial movement of the input member.

In a particular application of the invention the output member is drivably connected to the valve member of a rotary valve. In this arrangement the axially movable input member of the mechanism comprises a threaded spindle which is drivably connected with the rotatable output nut of a power operated actuator.

In order that the invention may be clearly understood the preferred embodiment will now be described with reference to the accompanying drawings, in which:—

Figure 1 is a sectional elevation showing the actuating mechanism of the invention

drivably connected with a power operated actuator for operating the valve member of a rotary valve;

Figure 2 is a developed view of a portion of the grooves or slots formed in the side walls of the fixed casing of the actuating mechanism; and

Figure 3 is a similar developed view of a modified form of the grooves or slots formed in the side wall of the fixed casing.

Referring now to the drawings and in particular to Figure 1 there is shown an actuating mechanism 10 which is basically operable to convert a linear or reciprocating movement of an axially movable input member 11 into a predetermined rotary movement of an output member 34. It will be appreciated that such a mechanism may have many applications but in the preferred application as shown in the drawings the actuating mechanism 10 is utilised for the operation of hand operated or power operated valves which require a rotary movement, for example a plug valve or a butterfly valve. Although the movement imparted to the input member 11 may be by means of a hand wheel the invention is particularly concerned with the possible use of a conventional valve actuator which is power operated and which is drivably coupled with the input member 11 through the usual rotatable nut member which will be hereinafter described. Such actuators may be of the kind described in our Patent Specifications Nos. 842,581, 865,565 and 939,353. In such conventional valve actuators the valve or other apparatus is normally actuated by the axial travel of a threaded output spindle which is movable when the rotatable input nut of the actuator is rotated. The preferred embodiment of the present invention provides an actuating mechanism which converts this axial thrust of the threaded spindle into an output torque which by suitable construction of the parts of the actuating mechanism can be made to have a desired output characteristic as will be hereinafter described.

The input member 11 of the actuating mechanism 10 comprises a threaded spindle as shown and this is drivably connected with a threaded nut 12 forming part of the actuator shown generally by the reference numeral 13. The output section of the actuator 13 comprises a rotatable output shaft 14 which is supported by a lower thrust bearing (not shown) mounted in the casing of the actuator. The rotatable nut 12 is slidably mounted within the end of the output shaft 14 and the nut member is formed with a flange 15 which abuts and seats on the lower end surface of the output shaft 14. The edge of the output shaft 14 at its lower end is formed with a pair of projections or dogs which are located diametrally opposite to each other and which extend axially into corresponding slots (not shown) in the flange 15 of the nut member 12. The drive from the output shaft 14 is always transmitted to the rotatable nut member through the dogs, but the axial force is contained by a short outer sleeve 16 which threadably engages the lower end of the output shaft 14 and is formed at its lower end with a flange 17 to engage the flange 15 of the nut member 12 firmly with the lower end of the output shaft 14.

In the arrangement so far described it will be appreciated that rotation of the output shaft 14 in one or other direction will produce a corresponding axial movement of threaded spindle 11 in one or other direction.

The threaded spindle 11 extends at its lower end axially into a fixed casing 18 which is formed with an upper fixing flange 19 and a lower flange 20 which as shown is attached to the flange 21 of a valve casing 22 by means of the bolts 23.

The lower end of the threaded spindle 11 is formed with a head 24 which carries a cross pin 25. Rollers 26 are mounted on the ends of the cross pin 25 and these rollers are movable in grooves or slots 27 formed in the side walls of the fixed casing 18.

The design of the grooves or slots 27 is most important as this decides the appropriate output torque characteristic of the actuating mechanism 10. In Figure 1 of the drawings the slots or grooves 27 are shown in their most simple form in that they are curved in shape and are oppositely positioned in the side walls of the casing 18 so that as the input spindle 11 moves axially the rollers 26 will slide along their corresponding slot or groove 27 and so constrain the head 24 and cross pin 25 on the threaded shaft 11 to follow a helical path. During this movement the head 24 and cross pin 25 rotate relatively to the fixed casing 18 as the threaded spindle 11 moves axially and this rotating movement of the cross pin 25 utilised to provide the rotary output for the actuating mechanism having a desired torque characteristic.

The cross pin 25 is provided with a second pair of rollers 28 which are positioned each between the head 24 and one of the rollers 26. The inner rollers 28 are slidably mounted in slots 29 which are formed in an inner rotatable casing 30 positioned within the fixed casing 18. The slots in the rotatable casing 30 extend axially parallel to the axis of the threaded input spindle 11 so as to allow the inner rollers 28 to move longitudinally along the rotatable casing 30 as the threaded spindle 11 moves axially relatively to the fixed casing 18. As the cross pin 25 is rotated during this movement of the input spindle 11, the inner rollers

28 carried by it engage the side walls of the grooves 29 in the rotatable casing 30 so as to move the casing 30 rotatably relative to the fixed casing 18.

The rotatable casing 30 is provided with an axially extending boss 31 which supports the output shaft 34 of the actuating mechanism 10 and the rotary movement of the output shaft 34 is utilised to operate the rotary valve member 32.

It will be appreciated that the rotary movement of the output shaft 34 may have any desired output torque characteristic which depends upon the design of oppositely located slots or grooves 27 in the side wall of the casing 18. In Figure 2 of the drawings a developed view is shown of the slots or grooves as indicated diagrammatically in Figure 1 of the drawings. The slots or grooves are curved around the side wall of the casing 18 so as to constrain the rollers 26 to follow a helical path and in this arrangement a constant output torque would be obtained for operating the valve member 32. It will, however, be appreciated that by flattening the angle or curve of the slots at the lower ends a greater torque can be obtained, for example as the valve reaches its closed position. Such an arrangement is shown in Figure 3 of the drawings where it will be seen that the lower ends 33 of the grooves or slots 27 are flattened in the axial direction of the casing 18. It is, of course, also within the scope of the invention to vary the slope of the curve of the slots or grooves 27 throughout their length.

It will be appreciated that the invention provides a simple mechanism whereby in its broadest aspect an axial movement is converted into a rotary movement having a desired output torque characteristic.

WHAT WE CLAIM IS:—

1. An actuating mechanism, more particularly for fluid flow control valves having a rotary movement, said mechanism comprising a fixed casing, an input member axially movable in said casing, a cross head or like member carried by said input member and constrained to follow a helical path when the input member is moved axially, said cross head extending through a rotatable casing in said fixed casing and being mounted therein for relative axial movement thereto whereby the helical movement of the cross head imparts a rotational movement to said rotatable casing.

2. An actuating mechanism as claimed in Claim 1, in which the cross head is provided with rollers or like members at its ends engaging helical grooves or slots in the side walls of the fixed casing.

3. An actuating mechanism as claimed in Claim 2, wherein the pitch of the helical grooves varies throughout their length to provide a desired output characteristic.

4. An actuating mechanism as claimed in any preceding claim, wherein the cross head is provided with rollers or like members intermediate its ends and engaging axial slots in the rotatable casing.

5. An actuating mechanism as claimed in any preceding claim, having an output member fixedly attached to the rotatable casing and extending from said fixed casing.

6. An actuating mechanism as claimed in Claim 5, wherein the output member is drivably connected to a rotary valve member.

7. An actuating mechanism as claimed in any preceding claim, in which the axially movable input member comprises a threaded spindle drivably connected with the rotatable output nut of a power operated actuator.

8. An actuating mechanism substantially as described and as shown in the accompanying drawings.

For the Applicants:—
F. J. CLEVELAND & COMPANY,
Chartered Patent Agents,
29 Southampton Buildings,
Chancery Lane,
London, W.C.2.

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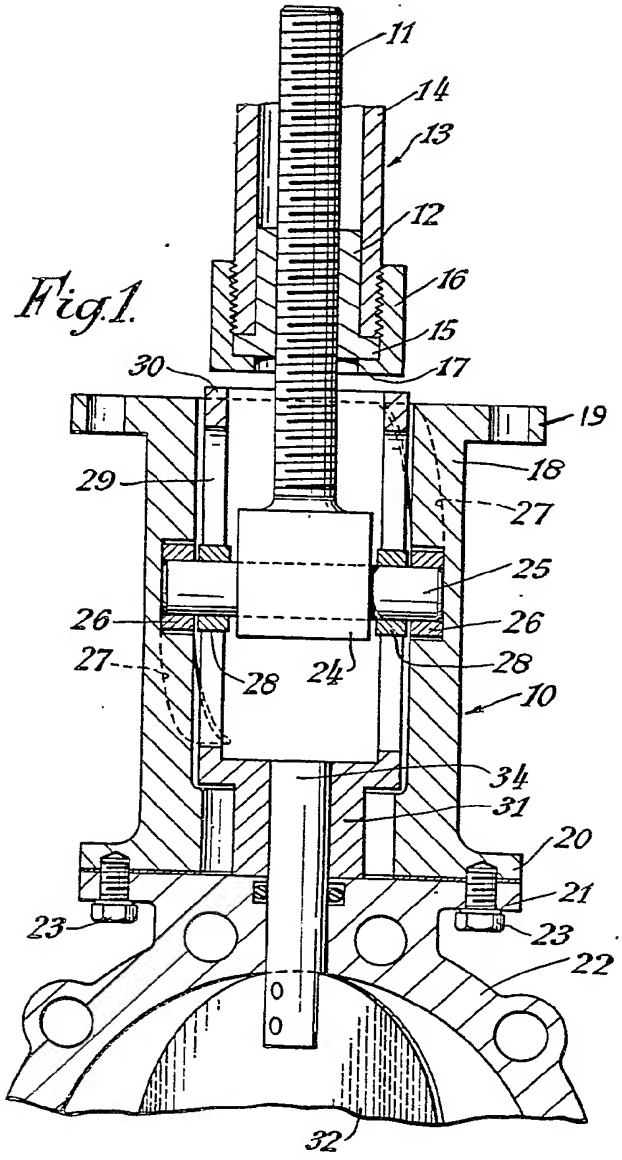
Fig.1.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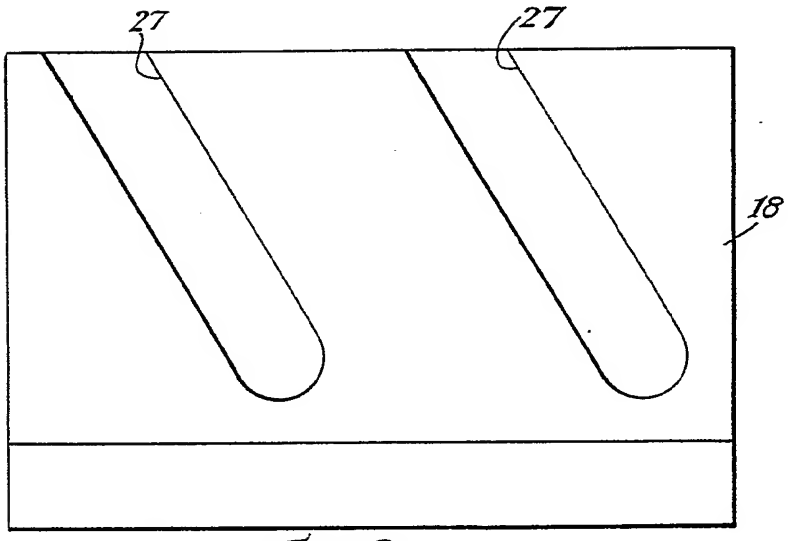
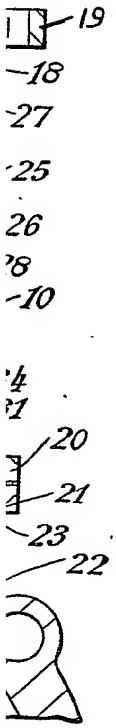


Fig. 2.



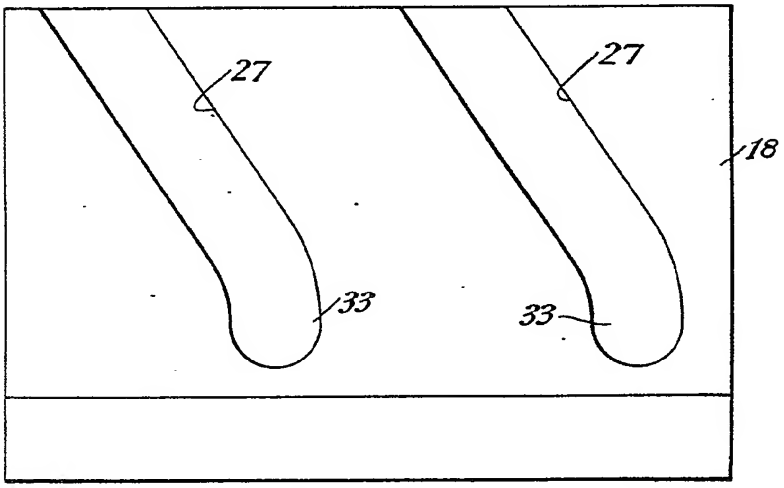


Fig. 3.

1001629 COMPLETE SPECIFICATION
2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
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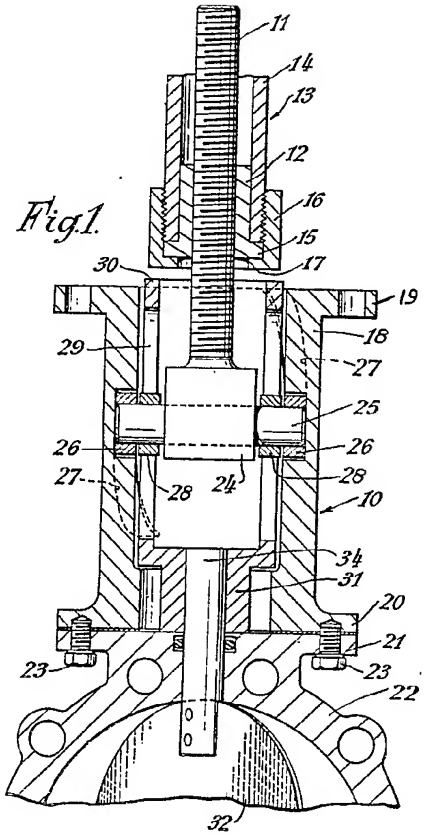

Fig.1.

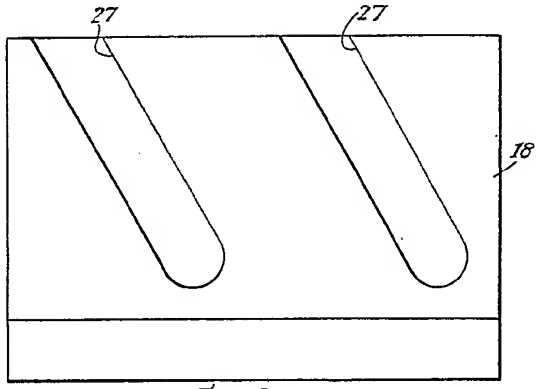

Fig.2.

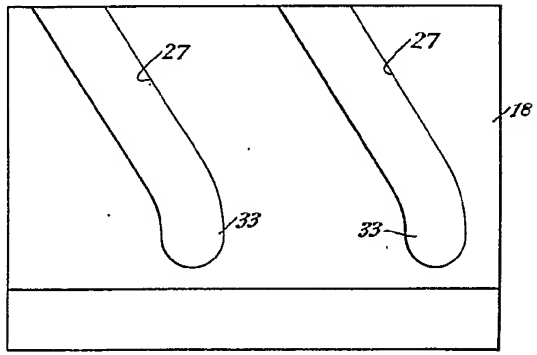

Fig.3.